CLAIMS

WHAT IS CLAIMED IS:

1. A system for preparing electrochemical materials, the system comprising a high temperature synthesis device for preparing an array of electrochemical materials as electrolytic surfaces of working electrodes, at least a portion of the electrolytic surfaces being defined by different materials, the device comprising:

a plurality of openings for receiving the array of working electrodes; and

a mask having a plurality of openings configured for exposing at least a portion of each of the working electrodes for forming the electrolytic surfaces on the working electrodes.

2. The system of claim 1 wherein the device is configured for processing of the electrolytic surfaces at a temperature of at least 300°C.

3. The system of claim 1 wherein the device is configured for processing of the electrolytic surfaces at a temperature of at least 1000°C.

4. The system of claim 1 wherein the system is configured for detachment of the working electrodes from the device after formation of the electrolytic surfaces on the working electrodes for subsequent testing.

5. The system of claim 1 wherein the device is configured for receiving an array of sixteen working electrodes.

6. The system of claim 1 wherein the device is configured for receiving an array of rotating disk electrodes.

7. The system of claim 6 wherein each of the rotating disk electrodes comprises an electrically insulating body and an electrically conductive insert supported by the body.

8. The system of claim 7 wherein the mask is configured to cover each of the bodies and said plurality of openings in the mask are configured to expose an end surface of each of the inserts.

9. The system of claim 1 wherein the device further comprises a holder block, said plurality of openings being formed therein.

10. The system of claim 9 wherein the holder block is generally cylindrical in shape.

11. The system of claim 9 wherein the holder block is formed from stainless steel.

12. The system of claim 9 wherein the holder block is formed from a polymer material.

13. The system of claim 9 wherein the mask is a generally flat plate configured for attachment to a front surface of the holder block.

14. The system of claim 1 wherein the device further comprises a back plate for retaining the working electrodes within the device.

15. The system of claim 14 wherein the back plate comprises a plurality of openings for providing access to the working electrodes.

16. The system of claim 1 further comprising an electrochemical cell comprising a cavity for containing a liquidus electrolyte and sized for receiving at least a portion of the array of working electrodes installed in the device.

17. The system of claim 16 further comprising an electrical connection created at each of the working electrodes for connection to an electrical source.

18. The system of claim 1 wherein said plurality of openings in the mask are tapered.

19. The system of claim 1 wherein an angle of each of the tapered openings is between 90 degrees and 120 degrees.

20. The system of claim 1 wherein an angle of each of the tapered openings is greater than 120 degrees.

21. The system of claim 1 wherein an angle of each of the tapered openings is less than 90 degrees.

22. The system of claim 1 wherein the mask is formed from stainless steel.

23. The system of claim 1 wherein the mask is formed for a ceramic material.

24. The system of claim 1 wherein the mask is formed from silicon.

25. The system of claim 24 wherein an angle of each of the tapered openings is about 70.529 degrees.

26. The system of claim 24 wherein each of the tapered openings is generally rectangular in shape.

27. The system of claim 1 wherein the mask is formed from Teflon.

28. The system of claim 1 wherein the electrochemical materials are electrocatalysts.

29. A method for preparing an array of electrochemical materials for subsequent screening, the method comprising:

inserting a plurality of working electrodes into a holder device comprising a mask having a plurality of openings configured for exposing at least a portion of each of said plurality of working electrodes for forming electrolytic surfaces on at least a portion thereof; and

creating the electrolytic surfaces on said plurality of working electrodes, at least a portion of the electrolytic surfaces being defined by different materials.

30. The method of claim 29 wherein creating the electrolytic surfaces comprises preparing the surfaces with a high temperature process.

31. The method of claim 30 wherein the high temperature process is performed at a temperature of at least 300°C.

32. The method of claim 30 wherein the high temperature process is performed at a temperature of at least 1000°C.

33. The method of claim 29 wherein said plurality of working electrodes comprises a plurality of rotating disk electrodes.

34. The method of claim 33 wherein each of said plurality of rotating disk electrodes each comprises a body and an insert supported by the body, the electrolytic surface being formed on the insert.

35. The method of claim 29 wherein creating the electrolytic surface comprises performing PVD deposition.

36. The method of claim 35 wherein performing PVD deposition comprises performing PVD deposition in a serial mode.

37. The method of claim 35 wherein performing PVD deposition comprises performing PVD deposition in a parallel mode.

38. The method of claim 29 wherein creating the electrolytic surfaces comprises liquid dispensing a solution onto at least a portion of said plurality of working electrodes.

39. The method of claim 29 wherein creating the electrolytic surfaces comprises ink printing a solution onto at least a portion of said plurality of working electrodes.

40. The method of claim 29 wherein creating the electrolytic surfaces comprises electroplating at least a portion of said plurality of working electrodes.

41. The method of claim 29 further comprising performing electrochemical screening on said plurality of working electrodes.

42. The method of claim 41 wherein performing electrochemical screening comprises creating an electrical connection at each of said plurality of working electrodes.

43. The method of claim 41 wherein performing electrochemical screening comprises at least partially inserting said plurality of working electrodes while retained in an array format in the holder device into a liquidus electrolyte.

44. The method of claim 43 further comprising detaching said plurality of working electrodes from the holder device and coupling said plurality of working electrodes to a drive system of an electrochemical cell for simultaneously evaluating multiple electrochemical reactions.

45. The method of claim 41 wherein performing electrochemical screening comprises detaching said plurality of working electrodes from the holder device.

46. The method of claim 45 wherein performing electrochemical screening further comprises inserting said plurality of working electrodes into a parallel electrochemical screening apparatus for simultaneous evaluation of electrochemical reactions.

47. The method of claim 45 wherein performing electrochemical screening further comprises:

detachably coupling a drive system to at least one of said plurality of working electrodes;

inserting said at least one working electrode in a liquidus electrolyte; and

effecting relative motion between the electrolytic surface of said at least one working electrode and a bulk portion of the liquidus electrolyte.

48. A system for preparing electrochemical material, the system comprising a high temperature synthesis device for preparing an array of electrolytic surfaces of working electrodes each comprising a body and an insert supported by the body, the electrolytic surfaces being formed by electroplating, the device comprising a holder block having a plurality of openings formed therein for receiving the array of working electrodes positioned such that a portion of the insert is exposed for forming the electrolytic surface thereon.

49. The system of claim 48 wherein the device comprises a high-temperature material allowing for preparation or processing of the electrolytic surface at a temperature of at least 300°C.

50. The system of claim 48 wherein the system is configured for detachment of the working electrode from the device after formation of the electrolytic surfaces on the working electrodes for subsequent testing.

51. The system of claim 48 wherein the holder block is configured for receiving an array of rotating disk electrodes.